# Importance of the Over the Wire Occlusion Balloon Catheter Designed for Intracranial Use

## Two Illustrative Cases

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***Summary***

*The over the wire occlusion balloon catheter is a new interventional neuroradiology tool. We present two cases where this system was crucial for the management. In the first case it allowed us to perform an occlusion test before closing in safe conditions a M2 fusiform aneurysm. In the second case, it allowed us to control a subarachnoid bleeding after endovascular perforation of a normal left P1 segment. We believe that all interventional neuroradiologists should be familiar and comfortable with the systems available.*

### Introduction

The over the wire occlusion balloon catheter was initially designed for endovascular treatment of aneurysms using the balloon-assisted coiling technique (remodelling technique) described by J Moret et Al[1]. As opposed to a dilatation balloon, the "remodelling" balloon needs to be soft and compliant to be minimally damaging to the vessel wall. The balloon is over the wire to increase its navigability and the stability during inflation. The system is small in diameter and very flexible so as to be used intracranially.

Such a balloon was designed and commercialised by MIS* (Solstice*) but disappeared with the company from the market. Fortunately, to our knowledge, there are now at least four similar systems available (Equinox*, MTI*-Irvine, Ca-; Magellan*, Balt*-Montmorency, France-; Sentry*, Target*-Fremont, Ca-; Commodore*, Cordis*-Miami, Fl). Recently, they have become essential tools in interventional neuroradiology and not only for the "remodelling" technique as demonstrated in the following cases.

*Case 1*

A 29-year-old woman was explored with CT scan for severe headaches and transient episodes of left facial paresthesia. This examination and subsequently an MRI revealed a non calcified right MCA aneurysm; no infarct was demonstrated. The clinical examination was normal and there was no suggestion of subarachnoid bleeding in the patient's history, following which aspirin 325 mg/day was given. The angiogram showed a large fusiform aneurysm at the origin of the right posterior parietal artery (figures 1A, 1B). Under local anaesthesia, aspirin (not discontinued) and heparinization (5000u in bolus + 1000 u/h, ACT control at 2h (for aprox 3X baseline)), an occlusion balloon catheter (Sentry* 10 mm, Target, Fremont, Ca) was positioned just distal to the aneurysm (the balloon could not be inflated proximal to

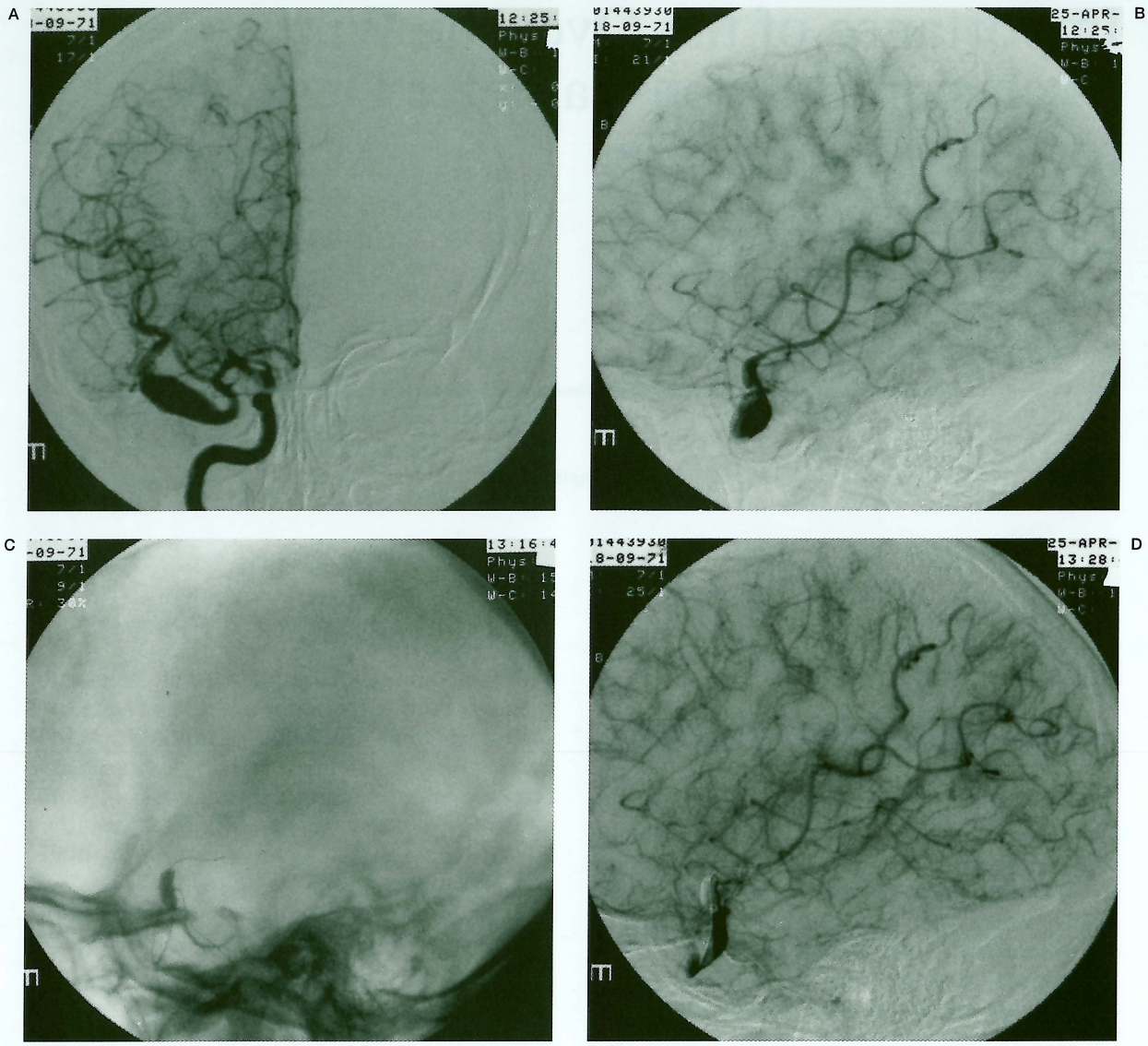
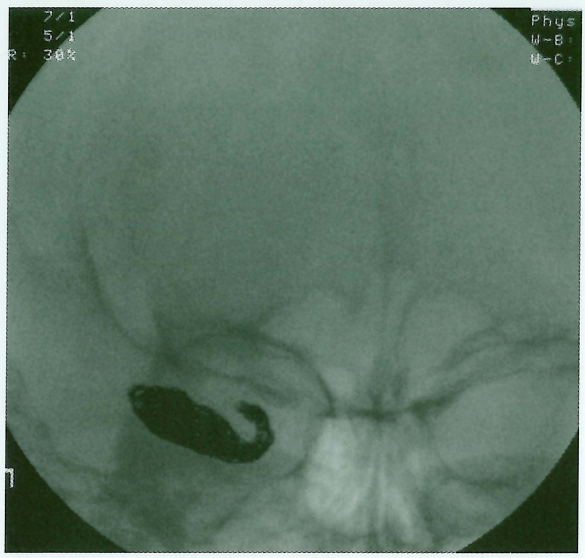



*Figure 1*

the aneurysm without bulging into the MCA bifurcation and was too small to occlude the aneurysm). After inflation, the right carotid injection showed that the right posterior parietal artery was filled via pial anastomoses and no defect was demonstrated on the parenchymography (figures 1C, 1D). After 20 minutes of occlusion the patient remain asymptomatic. The aneurysm and the parent vessel were subsequently closed using GDC coils (Target, Fremont, Ca) (figures 1E, 1F). The patient was left under heparin for 48 hours (8 mg/h) and aspirin (325 mg/day) for one month. She was discharged neurologically intact at day five. At six month follow-up the patient had no more headache or transient events and there was no reopening of the aneurysm on angiogram.

*Case 2*

A 54-year-old woman with polycystic kidney disease and familial history of aneurysm with subarachnoid bleeding was screened with CT angiography. This examination revealed an asymptomatic left ophthalmic segment aneurysm. An endovascular treatment was attempted in November 1998 but aborted because of the neck /aneurysm size ratio. Fifteen months later, a new endovascular treatment using the



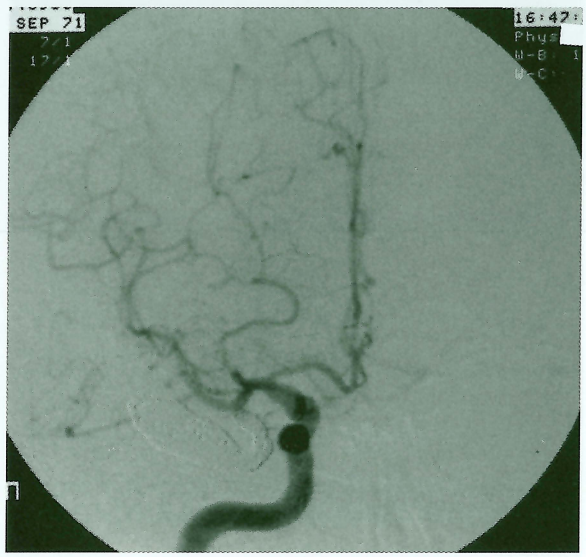




*Figure 1* A, B) case1: right carotid angiogram (AP view), shows a right middle cerebral artery fusiform aneurysm distal to the bifurcation. The lateral view (B), late phase, shows that the fusiform aneurysm is at the origin of the right posterior parietal artery. There is delay in filling of this artery. C, D) Case 1: occlusion of the right posterior parietal artery just distal to the aneurysm with an over the wire balloon. The late phase of the right carotid angiogram (D) shows that the posterior parietal artery is filled via pial anastomoses. E, F) Case 1: occlusion of the aneurysm and parent vessel with GDC coils (Target, Fremont, Ca). AP nonsubtracted view (E), right carotid angiogram in the same projection (F).

"remodelling" technique was scheduled. Under general anaesthesia, aspirin (325 mg per os the night before) and full heparinization, an occlusion balloon catheter (Sentry* 15 mm, Target, Fremont, Ca) was positioned in front of the neck of the aneurysm. The aneurysm, which had not changed since the first attempt, was coiled with GDC coils (Target, Fremont, Ca) using the remodelling technique (figures 2A, 2B). Positioning of the last coil pushed the microcatheter outside the aneurysm. At this stage, we were not satisfied with the packing (figure 2C). After several unsuccessful manoeuvres to reenter the microcatheter into the aneurysm, we decided to catheterise the aneurysm via the left posterior communicating artery which was fairly large, to approach the aneurysm from the top of the neck. This was attempted using an Excelsior microcatheter (Target, Fremont, Ca) with a Terumo 11 guide wire (Terumo, Tokyo, Japan). Unfortunately on the way, we perforated the left P1 segment, probably at the level of a perforating branch. Selective injection of the microcatheter, with 50% diluted contrast showed that the tip was in the subarachnoid space (figure 2D), but the hole was sealed off by the body of the microcatheter since the injection through the guiding catheter did not show any extravasation of contrast. The heparin was reversed; the balloon catheter was removed from the carotid and positioned in left P1 in front of the perforation (figure 2E). The microcatheter was removed from P1. Injection of the right vertebral artery showed that the patient was actively bleeding (figure 2F). The balloon was inflated for three minutes to obstruct the left P1 and the hole. On the control angiogram the patient was no longer bleeding and the left P1 was patent. The patient was then transferred to CT scan (figure 2G) where she woke up without deficit. The postoperative course was unremarkable except for moderate headache. The patient was left under aspirin for one month (325 mg/day). At day seven the patient underwent an angiogram. This examination ruled out vasospasm or a pseudoaneurysm at P1 level (figure 2H). The angiogram also showed that the contrast was no longer entering the aneurysm.

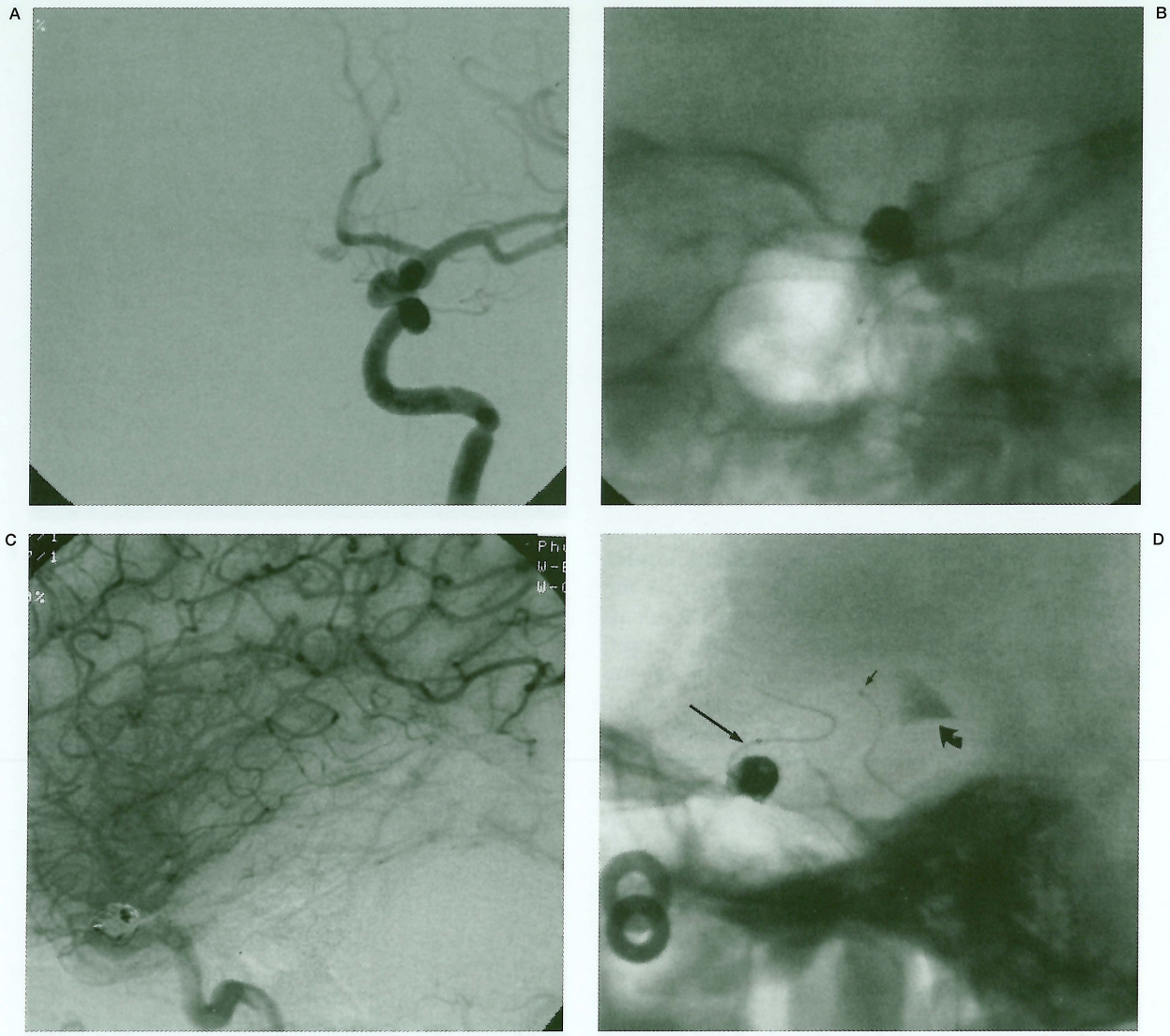



*Figure 2*

The patient was discharged the same day. A new angiogram was performed six months later and did not show any change.

## Discussion

Like many interventional neuroradiology teams, in our practice we often use the over the wire occlusion balloon catheter for: "remodelling technique", vasospasm angioplasty, catheterization of difficult intracranial branches by redirecting flow or by creating an obstacle where the microcatheter or microguidewire will bump into, or for angiographic occlusion test to understand complex anatomy.

However, these two illustrative cases are interesting because in both cases, the action of the occlusion balloon catheter was crucial, and we do not think that with another tool we would have been able to achieve the same result.

The etiology of intracranial fusiform aneurysm in young patients is not established with certainty but, according to Anson [2], "fusiform, dolichoectatic,and giant serpentine aneurysms may represent a spectrum of non saccular aneurysms that share a common gross and microscopic appearance, and these lesion may arise from the same pathophysiological mechanism: intimal disruption from dissection". Dolichoectatic and fusiform aneurysms cause

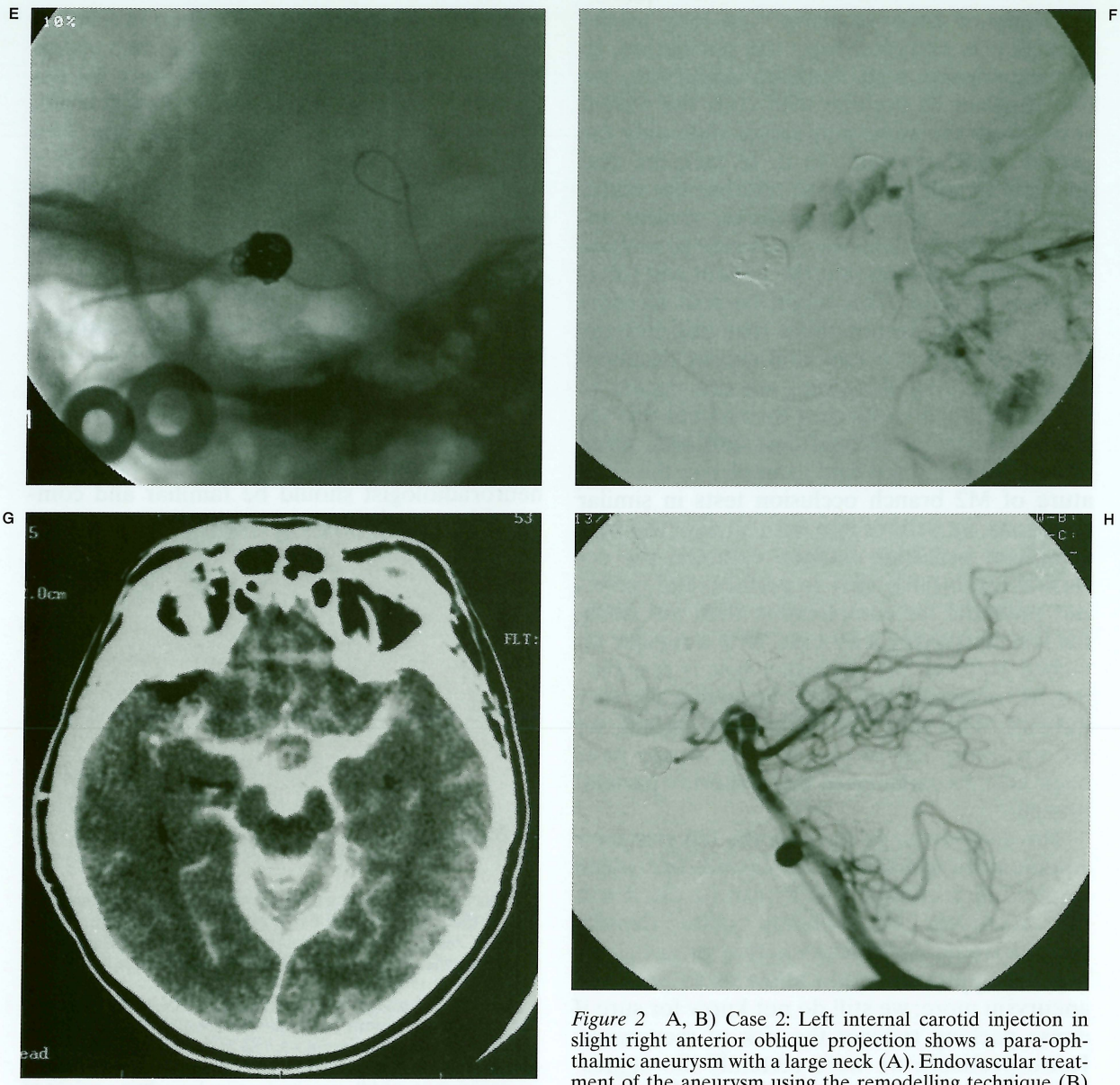



*Figure 2* A, B) Case 2: Left internal carotid injection in slight right anterior oblique projection shows a para-ophthalmic aneurysm with a large neck (A). Endovascular treatment of the aneurysm using the remodelling technique (B) (same projection as (A)). C) Case 2: Left internal carotid injection in lateral projection, shows unsatisfactory coiling of the aneurysm. Contrast is still entering the aneurysm. D) Case 2: Lateral view of the skull shows contrast in the interpenduncular cistern (curved arrow). The tip of the microcatheter, which has perforated the left P1 segment, is in the subarachnoid space (short arrow). The over the wire balloon is in the internal carotid artery (long arrow). E, F) Case 2: E) (lateral non subtracted view): The over the wire balloon has been removed from the carotid and is now in the left P1 segment, in front of the perforation. The microcatheter has been removed. F) Right vertebral injection, lateral view, late phase, shows extravasation of contrast in the subarachnoid space. G) Case 2: CT scan performed just after the procedure shows contrast and blood in the subarachnoid space. H) Case 2: Right vertebral injection performed 7 days after procedure (lateral subtracted view) shows normal appearance of the posterior circulation.

clinical symptoms that can be grouped according to three mechanisms: compression, ischemia or rupture [2]. In our case, the transient episodes of left facial paresthesia were most likely ischemic (blood flow impairment or microembolisms), even though the MRI did not show any infarct. It is more difficult to link the headache to the aneurysm, but a mass effect on the meninges might have played a role. The actual treatment of M2 fusiform aneurysm is parent vessel occlusion whether by proximal, distal, or occlusion at the level of the aneurysm,

surgically or endovascularly [2,3] so long as the aneurysm is excluded from the circulation. In our experience with fusiform aneurysm, we find it easier to occlude with coils the parent vessel from the aneurysm, rather than only the parent vessel proximal to it. In fact, the real question is: will the patient tolerate the occlusion? To deal with this problem, several approaches are possible: we can decide to occlude the branch assuming that the patient will tolerate the occlusion. This might be true in some cases [4], but we do not think that this strategy should be used in a non-vital urgent situation. As suggested by Borzone [3], we can decide to systematically do a surgical by-pass but this approach carries additional cost and risk. Even though we could not find examples in the literature of M2 branch occlusion tests in similar situations, we believe that with an over the wire compliant occlusion balloon catheter, the occlusion test is fairly easy to perform and carries less potential for complication than not doing the test or creating a by-pass. With a regular attached balloon, M1 occlusion test is feasible [5] but, M2 occlusion test might be technically very difficult. With that type of balloon system, we do not think that in our case we would have been able to catheterise the posterior parietal branch.

The decision to go through the left posterior communicating artery in the second case, which resulted in perforation of P1 can be discussed: the aneurysm was already quite densely packed; we do not know whether or not a retrograde approach would allow us to pack the aneurysm more; we still do not know for sure if dense packing reduces the risk of recurrence. Retrospectively, we were certainly too aggressive in the management of this case. However, we perforated the left P1 segment and we had to find a solution. Surgery would be very difficult because of the location of the perforation; additionally there would be nothing to clip. Coiling of the perforation would technically be possible but we felt that it would be extremely difficult to stabilise the coil without important bulging in P1. Leaving the microcatheter in the subarachnoid space was an option, but we were concerned by the risk of clotting in the posterior circulation. Retrieving the catheter without additional manoeuvre was also an option, but we had no guarantee that there would not be major bleeding. Finally, we thought that the best solution was to place a balloon in front of the perforation, even though this manoeuvre increased the risk of clotting in P1 since the heparin had been reversed. For obvious reasons, the balloon needed to be compliant and very stable during inflation. Again we think that it would be difficult to stabilise a regular balloon in this stressful situation.

## Conclusions

An over the wire occlusion balloon catheter is a new interventional neuroradiology tool which has recently become very important. Of course, the different systems could be improved and other sizes could be proposed. However, we believe that all interventional neuroradiologist should be familiar and comfortable with the systems available.

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